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## SECURITY CHALLENGES AND DEVELOPMENT OF SEAPORTS: EDUCATIONAL CONTEXT

**Summary.** *The paper deals with implementation of the function of ensuring economic security by seaports. In the absence of a generally accepted statistical basis for the analysis of seaports, the experience of countries is used as arguments. The logic of the research involved the construction and analysis of a competitive map of the world port market. World trends show a reduction in place states play in decision-making related to the development of ports and the expansion of composition and role of other stakeholders. The main challenges to the development of seaports are identified: focus and consistency of countries' activities; implementation of international infrastructure projects; dependence on trade flows, development of logistics chains; willingness of countries to make long-term investments; improvement of the quality of port ties with the system of professional and higher education, scientific and analytical organizations.*

**Key words:** port, critical infrastructure, security, education, university, competitive market map, world market.

**Statement of problems.** In general, the issues of reliability of seaports are directly related to the macro- and foreign economic, financial, social, energy and food security of countries. Development of seaports, as outposts of the internationalization of activities of economic infrastructure, should be considered from all aspects, and if some of them is being neglected, it may lead to negative consequences. An example of this is the fact that the flag of Ukraine was included in the blacklist of the Paris memorandum in connection with the unsatisfactory security level of transportation and navigation management [7]. The need for a diversified development of seaports is even emphasized by the International Labor Organization, who expects ports to be developed as a well-regulated safe business and standardized operations [10].

Insufficient attention, which has been paid for a long time in Ukraine to the issues of development of higher education, effective links with the sectors of the economy, including its infrastructure sector, calls on challenges and constitutes a problem for the development of seaports. The similarity between universities

and ports, which are key producers in their sectors, may cause similarities in approaches to their development, as important creators of the competitive advantages of national economies.

Attracting investments and long-term credits into development of ports should be based on the mechanism of public-private partnerships, the ability to identify and distribute risks and methods that comprehensively assess all the factors and dimensions. One of the examples is attraction of resources of the Japan Agency for the Development of International Cooperation into modernization of Lithuanian port of Klaipeda, which has been increasing its turnover since 1999 [8]. Functioning of recruitment agencies and training institutions, development of IT and ICT infrastructures, cybersecurity, management, design, research and construction services, formation of networks and supply chains are the examples, when important functions for port development are often effectively carried out by private structures.

Significant public investments into infrastructure development have become the foundation of the "Korean miracle" [14]. Obviously, shipbuilding and port infrastructure have become the basis for the active development of other Korean enterprises. At the same time, Ukraine, which inherited well-developed port infrastructure, for decades could not demonstrate such a miracle, and over the past 5 years the volumes of transit cargo processing have negative dynamics in most ports.

**Analysis of publications.** Bibliographic analysis of one of the leading scientometric databases (*in our case – Science Direct*) for the keywords "port" and "security" revealed that over the past 20 years number of publications was increasing annually and previous peak of interest in such research was in the mid-1990s. However, for "seaports" such an increase in interest is observed for the first time for all accessible period of observations. In recent years there is general understanding that competition for the use of transport infrastructure, as key way to get access to domestic markets, increases globally, which leads to increase in economic security risks.

It is evident that in different countries issues of development of seaports and related security issues are at various levels of qualitative consideration. Unfortunately, we have found that in Ukraine comprehensive publications in the field of development of seaports are in lack and can't fully contribute to nations' goals in the face of the growing impact of international challenges. Naumova L. focuses just on the need to stimulate the development of seaports [4]. Korniyenko O. refers to the ports of the first generation, that are only able to ensure the safety of basic functions, but completely forgets about the participation of ports of all four generations in ensuring economic security [2]. Kryuk Y. draws attention to ports as subjects that provide technological and economic security of the countries in their integration into the Euro-Asian transport space [3]. Some researchers confine themselves to the grouping of prerequisites and factors of port development [5].

In conditions when the development of European transport corridors,

especially between the Baltic and Black Seas, is to bypass Ukraine, the low regional competitiveness of domestic seaports causes a decline in the competitive positions of national economy. One of such examples is the announcement of plans to revive the Great Silk Road outside the borders of Ukraine [19; 9].

In the current legislation of Ukraine variety of critical infrastructure development issues is limited solely to cyber-security and certain aspects of technogenic security. However, in the current version of strategy for development of seaports in Ukraine, cybersecurity is not mentioned at all [6]. Meanwhile, the strategy refers to problems of low level of technical and ecological safety, navigation, life and health, economic and operational security of port infrastructure and port surveillance of maritime transport, effective functioning and development of technical and information systems for the safety of navigation. But little attention has been paid to development of relationships between ports and universities, analytical and research organizations, which leads to poor decision making.

The earlier analysis of the competency-based model of development of seaports also contains a significant array of issues related to safety and security [1]. So, the general business competencies of the workers of port sector include issues of labor protection and safety engineering, transportation of dangerous goods, security and port protection; port logistics competencies –security measures for equipment and port engineering [20]. Persons who make strategic decisions should also possess a full range of professional, as well as managerial and business competencies, including strategic planning and productivity management.

One of methodological obstacles to comparing efficiency of functioning of ports is lack of a generally accepted system of statistical measurements and methods for their calculation. Thus, in order to measure ports' activity in usage of instruments for increasing the production of services, researchers propose to add index calculations [18]. It should be noted that, depending on direction of trade, the share of scientific and educational component in the index is from 12,9% to 13,6%, although in fact it is higher, as it is included in other indicators, for example, security and traffic management. It is vital to introduce tools used in other fields to analyse the dynamics of market positions, in particular the compilation of competitive maps.

**General and specific problem.** The lack of understanding of market conditions for development of ports in the process of deepening of global relationships leads to demonstration by many countries of traditional approaches to the implementation of strategies for their further development. Modern seaports require long-term investments, multifaceted approaches to the formation of strategies, an active search for market niches and involvement of all stakeholders to ensure the effectiveness of functions performed.

The world economy continues to grow, which is ensured by the efficient functioning of the port infrastructure, through which about 80% in volume or

70% in value measure of world trade in goods pass [17]. In this regard, the authors are invited to consider the construction of a competitive map of the world market of port services as an argument for further liberalization of the conditions for development of ports at national level.

**The purpose of the article** is to expand understanding of complexity of relationships and ties that ensure the efficiency of seaports as open ecosystems and increase their contribution to ensuring competitiveness of companies and national economy in changing architecture of global market of port services. At the same time, it is planned to pay special attention to the scientific and educational aspects of development of ports as an economic infrastructure.

**The main content of the paper.** Developed countries are most often considered as examples for development of ports. In the EU, ports are classified as critical infrastructure objects [16]. In the US, 361 ports are classified as components of the maritime transport system, which is a subsector of critical infrastructure, for development of which one of the five objectives since 2014 has been defined as provision of education, training and awareness in the field of security [21]. Thus, there is a need for a system of professional and higher education, which provides training and research, and prepares an analysis for the interests of ports. As a result, you can clearly outline a certain niche in the educational market.

American experience is also valuable because a model, which was developed for analysing the safety of marine risks, is used to manage terrorist risks. Management of the risks to functioning of US seaports is significantly diversified and decentralized (for example, there are 43 maritime safety committees functioning) and is carried out with participation of all stakeholders, cooperation of state bodies and direct port owners who make joint decisions based on research, thorough situation assessment, bottleneck analysis, prioritization and accountability.

Decentralization of China's port industry is accompanied by a number of related processes. Decentralization and trends of slowing international trade and economic development have led to the formation of excess port capacities in China, which are now underutilized by 35% overall, and the competition between ports has increased [15]. It is important for us that among the mandatory directions to overcome the difficulties in development of port industry in 2014 Chinese named the improvement of education and training of personnel, as well as the acceleration of scientific research and technology. Market map should show different effectiveness of port development strategies in China and other countries.

Projects for the development of cooperation to form port clusters, as players who are to ensure higher level of economic security, must take into account scientific and educational component that can unite actors of different size and industry into a single system on a mutually beneficial basis. Therefore, Italian researchers in order to develop a competitive Mediterranean cluster offer to use joint training of personnel, the exchange of employees, knowledge bases

and data [12].

Considering port industry as a set of interrelated actors, it is necessary to recognize the existence of leaders who set trends, as well as outsiders, who do not cope with the tasks. To identify them business practice uses construction of competitive market maps. Our competitive map demonstrates that even ports that function within one country show different dynamics, occupying different niches (Table). The uniqueness of each of 200 ports in the sample causes the need for individual approaches to their development, which means decentralization for big countries, but in small countries may be justified by thorough decision making.

Analysis of the competitive map reveals the positions of individual ports in dynamics. It shows that for the past 8 years ports have been moving in various directions within global market. Our experience within port industry let us conclude that ports, which were better off, take advantage of from long-term strategies, plans, investments and ties. One shall also take into account that trade in goods with high value added in most cases uses container shipment, while the data we used to build the map includes total volume of goods traded in tonnes. So in many cases these ports serve trade in low value added goods.

Simultaneously their combined aggregates make up positions for each country. So, we find that sea ports of China, Australia and Malaysia are developing most dynamically, which leads to decrease in market shares of other countries, which are not that effective. At the same time, the USA, South Korea, Japan, Brazil, Netherlands, Singapore and India are losing their strong positions. All of these two groups of countries can be called the main maritime countries of the world. Note that the size of market shares of the EU countries is much smaller, because they actively use other modes of transport to trade within Europe. We find that Ukraine, Poland, Lithuania, Latvia, Russia, Greece, Turkey and Sweden are also losing their positions, which are characterized as weak. To outsiders at the moment we can place Bulgaria and Portugal.

The uniqueness and variety of ports and interests of stakeholders in market conditions leads to the need for decentralization model for their development, which implies an increase in the industry's readiness to operate in competitive port environment amongst themselves, as well as with foreign competitors. It takes a long time to form international competitiveness and efficiency of the industry and depends on many factors and institutional players; therefore, to transfer to competitive conditions, industry leaders and personnel (including internal dry and sea ports) must be ready, possess relevant competencies (well-trained) and knowledge [13].

Table 1. Global Port Market Map in 2008-2015.

growth rate of market share	actors by size of market share		
	leader	strong competitive position	weak competitive position
rapid improvement of competitive position		Tangshan, Xiamen, China; Port Hedland, Australia; Southampton, UK; Lianyungang, Rizhao, Yantai, Nanjing, Qingdao, China; Newcastle, Australia	Callao, Peru; <b>Yuzhnyy, Ukraine</b> ; Durban, South Africa; Banjarmasin, Indonesia; Flushing, Netherlands; Yanbu, Saudi Arabia; Yanbu, Saudi Arabia; Chittagong, Bangladesh; Jubail, Saudi Arabia; Cartagena, Columbia; Paradip, India
improvement of competitive position	Shanghai, China	Nantong, China; Tanjung Pelepas, Malaysia; Santos, Brazil; Saigon New Port, Vietnam; Port Kelang, Malaysia; Busan, Kwangyang, South Korea; Hay Point, Australia; Tubarao, Brazil; Guangzhou, China; Gladstone, Australia; Algeciras - La Linea, Spain; Corpus Christi, USA; Dalian, Ningbo, China; Richards Bay, South Africa; Dampier, Australia; Metro Vancouver, Canada; Tianjin, China; Dubai Ports, United Arab Emirates	Lazaro Cardenas, Mexico; Laem Chabang, Thailand; Saldanha Bay, South Africa; Taichung, Taiwan; Karachi, Pakistan; Ambarli, Turkey; Baton Rouge, USA; Paranaguá, Brazil; Manila, Philippines; Beaumont, USA; Aliaga, Turkey; Angra dos Reis, Brazil; <b>Riga, Latvia</b> ; Quebec, Canada; New Orleans, USA; Izmit (Kocaeli), Turkey; Jeddah, Saudi Arabia; Trieste, Italy; <b>Klaipeda, Lithuania</b> ; Bombay, India; Valencia, Spain; Brisbane, Australia; Tanjung Priok, Indonesia
deterioration of competitive position	Singapore, Singapore	South Louisiana, Houston, USA; Incheon, South Korea; Rotterdam, Netherlands; Antwerp, Belgium; Itaquí, Brazil; Amsterdam Ports, Netherlands; Kobe, Japan; Chiba, Japan; Ulsan, South Korea; Hong Kong, China; Hamburg, Germany; Qinhuaogdao, China	Jawaharlal Nehru India; Corpus Christ, USA; Hakata, Japan; Alexandria Egypt; Fremantle Ports, Australia; Texas City, USA; Daesan, South Korea; Botas, Turkey; St. Louis, Lake Charles USA; Sydney Ports, Australia; Tokyo, Japan; Septetiba, Brazil; Liverpool / Mersey-side, UK; New Mangalore, Visakhapatnam India; Los Angeles, Pascagoula, Baltimore USA; Tarragona, Spain; Bandar Abbas, Bandar Khomeini, Iran; Sao Sebastiao, Brazil; Bremerhaven, Germany; Long Beach, USA; Milford Haven, UK; Savannah, USA; Leghorn, Italy; San Lorenzo-San Martin, Argentina; Genoa, Italy; Calcutta, India; Constantza, Romania; Barcelona, Spain; Grimsby and Immingham, UK; Zeebrugge, Belgium; Gothenburg, Sweden; Novorossiysk, Russia; Chennai (Madras), India; Nantes St.Nazaire, France; Mina Sulman, Bahrain; Mobile, USA; Aratu, Brazil; Osaka, Japan; Hampton Roads USA; Calais, France; St. Petersburg, Russia; London, UK; Marseilles, France; Le Havre, France; Pitsburgh, Plaquemines, USA; Bergen, Norway; Taranto, Italy
rapid deterioration of competitive position		Kitakyushu, Japan; Nagoya, Japan; Shenzhen, China; New York / New Jersey, USA; Yokohama, Japan; Kaohsiung, Taiwan	Chicago, Tampa, Jacksonville, Paulsboro USA; Wilhelmshaven, Germany; Forth Ports, UK; Mormugao, India; Yingkou, China

Source: developed by authors, port names and list as of American Association of Port Authorities [22].

One of the attributes of decentralization in port industry is presence of conflicts, especially between the state and private institutions, successful resolution of which contributes to increase of ports' competitiveness. These conflicts are typical both for developed and developing countries [11]. Therefore, proper training, preliminary studies of scenarios, clear documentation of agreements are prerequisites for international competitiveness of ports and efficient economic security.

Ports make effective use of international division of labor possible, so countries may experience and expect sustainable development in context of economic security. China, South Korea, Malaysia and Singapore are the best countries to show such effectiveness of port as infrastructure due to long-term strategies and investments, which incorporated all aspects from security to educational issues.

**Conclusions and prospects for further research.** Development of global port market shows that ports of any country are characterized by different dynamics of market positions. The main challenges for the development of seaports in context of international security include the following issues:

- targeted and consistent countries' activities to ensure economic security;
- policies of implementing international infrastructure projects;
- dependence from international and national trade flows, construction and development of logistics and production chain and centers;
- readiness of countries, budgets of different levels and national capital markets, to make long-term investments;
- improvement of quality of interrelations between all stakeholders of port development, especially with the system of professional and higher education, scientific and analytical organizations.

Countries should prepare ports for possible fluctuations in the demand for their services, which is possible primarily on the basis of appropriate training of personnel. Such volatility affects the effectiveness of economic security, so countries should have adequate reserves, the size of which depends on the measure of market flexibility, tightness of ties between stakeholders, and quality of educational, scientific and analytical support.

Implementation of national strategies for port development shows both the changing role of state and the need to systematically address development issues with active participation of higher education institutions, research and analytical organizations. Development of Ukraine's seaports is facing the problem of decentralization, which is also typical for development of domestic universities. Universities and ports should become more autonomous institutions that can respond more effectively to dynamic challenges, implement marketing strategies, influence the development of other economic agents, and provide high quality services. In Ukraine, where the law on seaports defines only certain strategic objects of port infrastructure, ports are not recognized as critical or strategic infrastructure, so ports' role in ensuring national economic security should be more clearly defined.

The above arguments and conclusions can be a source for further discussions of strategies and plans, as well as exploring ways to develop seaports in globalized world economy. We believe that analysis of port market map in terms of container shipment may give better insights into understanding the nature of development of the global port market.

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